

Claims 1-10 were pending in the subject application prior to the aforementioned amendment. By this Amendment, claim 5 is canceled and claim 1 is amended. Accordingly, claims 1-4 and 6-10 are currently pending herein and are in condition for allowance at least for the reasons advanced hereinbelow.

**A. 35 U.S.C. §102 Rejection**

Claims 1, 2, 4, 5, 7 and 8 stand rejected under 35 U.S.C. §102(b) as anticipated by U.S. Patent No. 5,541,436 to Kwong et al. ("Kwong"). Claim 5 is canceled by the above actions, thereby rendering the rejection moot with respect thereto. With regard to the remaining rejected claims, Applicant respectfully contends that the claimed invention as presently amended is clearly patentably distinct over Kwong for at least the following reasons.

**1. Summary of the Invention**

The claimed invention is directed generally to a method of fabricating a semiconductor device comprising the steps of forming a silicon oxynitride film on a silicon substrate, performing a heat treatment while keeping a surface of the silicon oxynitride film in contact with a gas containing nitrogen and oxygen to introduce at least nitrogen into the silicon oxynitride film, forming a semiconductor film containing an impurity of first conductivity type on the silicon oxynitride film, forming a gate electrode that composed of the semiconductor film by patterning the semiconductor film, and forming a gate insulating film that composed of the silicon oxynitride film by patterning the silicon oxynitride film.

**2. Kwong Clearly Fails to Teach the Invention**

Applicant respectfully contends that the Kwong fails to expressly teach or inherently describe each and every element set forth in claimed invention. For instance, as illustrated in

FIGS. 1 and 2, Kwong teaches a method of fabricating a semiconductor device wherein a silicon oxynitride film 20 is formed on a silicon substrate 10 by using  $N_2O$  gas, and subsequently nitriding the silicon oxynitride film 20 by performing a heat treatment in  $NH_3$  gas. Thus, while the silicon oxynitride film 20 is nitrified in  $NH_3$  gas in accordance with the teachings of Kwong, the claimed invention as presently amended requires the introduction of nitrogen into the silicon oxynitride film using a gas containing both nitrogen and oxygen. Hence, method in accordance with the teachings of Kwong clearly differs from that which is claimed in the present invention.

Accordingly, since Kwong patent fails to expressly teach or inherently describe every claim limitation necessary to support anticipation under §102, it is respectfully requested that the rejection be reconsidered and withdrawn.

#### **B. 35 U.S.C. §103 Rejections**

Claim 3 stands rejected under 35 U.S.C. §103(a) as unpatentable over Kwong in view of U.S. Patent No. 6,127,227 to Lin et al. ("Lin"), claim 6 stands rejected under 35 U.S.C. §103(a) as unpatentable over Kwong in view of U.S. Patent No. 5,712,208 to Tseng et al. ("Tseng"), claim 9 stands rejected under 35 U.S.C. §103(a) as unpatentable over Kwong in view of U.S. Patent No. 5,817,562 to Chang et al. ("Chang"), and claim 10 stands rejected under 35 U.S.C. §103(a) as unpatentable over Kwong in view of U.S. Patent No. 6,391,732 to Gupta et al. ("Gupta"). Applicant contends that the claimed invention as presently amended clearly defines patentably over each of the proposed Kwong combinations for at least the following reasons. Reconsideration is earnestly solicited in view thereof.

#### **1. Summary of the Invention**

As previously mentioned in response to the §102 rejection, the claimed invention is directed generally to a method of fabricating a semiconductor device comprising the steps of forming a silicon oxynitride film on a silicon substrate, performing a heat treatment while

keeping a surface of the silicon oxynitride film in contact with a gas containing nitrogen and oxygen to introduce at least nitrogen into the silicon oxynitride film, forming a semiconductor film containing an impurity of first conductivity type on the silicon oxynitride film, forming a gate electrode that composed of the semiconductor film by patterning the semiconductor film, and forming a gate insulating film that composed of the silicon oxynitride film by patterning the silicon oxynitride film.

Accordingly, nitrogen is introduced into the silicon oxynitride film that is used as a gate insulating film by performing a heat treatment while keeping the silicon oxynitride film in contact with a gas containing both nitrogen and oxygen. As a result, the nitrogen concentration within the silicon oxynitride film is increased and a nitrogen concentration distribution having a steeply sloped configuration is obtained. Moreover, by using the silicon oxynitride film as a gate insulating film, a suppression of the reduction in threshold voltage is obtained and a transistor having an enhanced high driving force is formed.

## **2. The Proposed Combination of References Clearly Fail to Disclose the Invention**

Applicant respectfully contends that each of the proposed Kwong combinations fail to teach, disclose or suggest each and every limitation set forth in the claimed invention necessary to support a *prima facie* case of obviousness under §103. For instance, the base reference Kwong discloses nitriding a silicon oxynitride film 20 in an  $\text{NH}_3$  gas while the claimed invention specifically requires introducing nitrogen into the silicon oxynitride film using a gas containing both nitrogen and oxygen.

Regarding claim 3, Lin discloses using amorphous silicon as a floating gate material in EEPROM. Lin, however, fails to disclose a step of performing a heat treatment for activating an impurity in order to change the amorphous silicon film into a polysilicon film, as is required by claim 3 of the present invention. Thus, the combination of Kwong and Lin is deficient in at least this regard as well as for the lack of introducing nitrogen into the silicon oxynitride film using a gas containing both nitrogen and oxygen.

Regarding claim 6, Tseng discloses two methods of forming a dielectric layer 112 containing nitrogen. See, col. 7, lines 35-65. In the first method, the dielectric layer 112 is formed by oxidizing a substrate with O<sub>2</sub> mixed or followed by one or more of N<sub>2</sub>O, NO, NO<sub>2</sub>, or NH<sub>3</sub>. In the second method, initially, a thermal oxide layer is formed by oxidizing a substrate with O<sub>2</sub> or H<sub>2</sub>O, and then forming the dielectric layer 112 by annealing using a nitrogen-containing ambient such as N<sub>2</sub>O, NO, NO<sub>2</sub>, or NH<sub>3</sub>. Thus, Tseng discloses forming the dielectric layer 112 in either the first or second method. Thus, Tseng lacks the technical scope of introducing nitrogen into a silicon oxynitride film using a gas containing both nitrogen and oxygen. Accordingly, even if Kwong and Tseng were combined, the claimed invention would not result since Tseng requires using N<sub>2</sub>O gas to form a silicon oxynitride film, and both references lack introducing nitrogen into a silicon oxynitride film using a gas containing both nitrogen and oxygen.

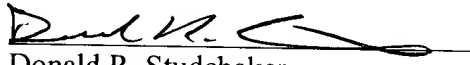
The Chang and Gupta references also lack the aforementioned feature, namely, introducing nitrogen into a silicon oxynitride film using a gas containing both nitrogen and oxygen. Thus, their combination with Kwong fails to result in the claimed method set forth in the present invention.

Accordingly, since each of the proposed Kwong combinations lack any express teaching or disclosure of every limitation set forth in the claimed invention, a *prima facie* case of obviousness cannot be supported. Accordingly, it is respectfully requested that the rejection be reconsidered and withdrawn.

**Conclusion**

In view of the foregoing comments, Applicant respectfully contends that the claimed invention is patentably distinct over the prior art of record and that the pending claims are in proper condition for allowance. Reconsideration of these claims in view of the above comments is respectfully requested. If the Examiner believes further discussions with Applicant's representative would be beneficial in this matter, he is invited to contact the undersigned.

Respectfully submitted,

  
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**MARKED-UP COPY OF AMENDED CLAIM 1**

1. (Twice Amended) A method of fabricating a semiconductor device, the method comprising the steps of:

- (a) forming a silicon oxynitride film on a silicon substrate;
- (b) performing a heat treatment while keeping a surface of the silicon oxynitride film in contact with a gas containing nitrogen and oxygen to introduce at least nitrogen into the silicon oxynitride film;
- (c) after step (b), forming a semiconductor film containing an impurity of first conductivity type on the silicon oxynitride film;
- (d) after step (c), forming a gate electrode composed of the semiconductor film by patterning the semiconductor film;
- (e) after step (d), forming a gate insulating film composed of the silicon oxynitride film by patterning the silicon oxynitride film.